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FORECASTING NON-PERFORMING LOAN: PERSPECTIVE OF BANGLADESH

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Abstract
Non Performing loan is growing gradually with respect to time in Bangladesh. In this paper, we discuss the trend of Nonperforming loan (NPL) in the banking sector of Bangladesh. The paper discloses that the alarming amount of NPLis gradually increasing in the Banking sector of Bangladesh as well as the flaws and suggestions regarding the recovery ofNPL. Finally, we develop a linearregression model for the forecasting of NPL in Bangladesh. This model helps to forecast how much NPL increased in near future that help us to give the focus of recuperating the loan.
Keywords: *Time series, ARIMA, ACF, PACF, ADF, Stationary, Autoregressive, Moving average, NPL*

Introduction

A Non-performing credit refers to a loan that become defaulted or about to be defaulted. Numerous credits turn into non-performing subsequent to remaining unpaid for 90 days, however terms of the agreement can make a difference. IMF defines an NPLs as "An advance is nonperforming when installments of intrigue and chief are past due by 90 days or more, or if nothing else 90 days of intrigue installments have been promoted, renegotiated or deferred by understanding, or installments are under 90 days late, however there are other valid justifications to question that installments will be made in full" (Wikipedia, definition of NPLs)
Bank administrative states that non-performing credits comprise of Credits that are due for 90 days or more and are still accumulating interest and Loans are set on nonaccrual.

Credit may also be referred to as non-performing in a situationwhere it is used in an unanticipated manner rather thanthat for which it has been granted. Bank Company Act 1991, Section 5 (cc) states “defaulting account holder' signifies any individual or foundation presented with advance, credit conceded for him or an establishment including premium or any segment thereof, or any premium which has been past due for a half year as per the meaning of Bangladesh Bank”. Non-performing advances are also known as non-performing resources (NPA), are credits categorized by a bank or a monetary foundation through thedirection of the administrative authority, on which repayments or installments for premium are not being paidaccording to the scheduled time. An advance means a prepayment to a bank as the premium installments and the return of the chief make a torrent of money inflows. Premium money inflow is excess cash overhead, which is namedas benefit.

In most of the cases Banks names resources as non-performing, in a situation that they are not overhauled in booked time. In an event of installments are late for a while, a credit is referred to as past due. If an installment turns out to be late for as long as 60 days, the credit is regarded as non-performing.

NPL is an entirety covering both of the received credit whereupon the borrower has not made his/her planned installments, which is already defaulted or about to be defaulted. If an advance become nonperforming, there are little chances that it will be paid back in fully.As soon as the defaulterstarts making installments against the non-performing advance, it is retrieved as a performing advance.

As indicated by European Central Bank, the ECB has played out an exhaustive evaluation and created standards to characterize advances as nonperforming on the off chance that they seem to be: unpaid for 90 days, regardless of being recorded as not defaulted or weakened, reduced as for the bookkeeping points of interest for banks following GAAP and International Financial Reporting Standards (IFRS) and Capital Requirements Regulation indicates it as default.

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Classified loans

An arranged advance is regarded as any advance that a bank analyst has stated to be at threatof being defaulted. It is not necessary for a defaulter to miss an installments demand for a bank to mark the record thusly. As the bank states a borrower can have credit for various purposes. This is only a safety measure for budgetary establishments against a probabledisaster and to forestall any supplementaryvulnerability.

The Bangladesh Bank describesa credit ordering framework consists of 8 levels, namely, Superior, Good, Acceptable, Marginal, Special Mention, Sub-standard (SS), Doubtful (DF) and Bad/Loss (BL). Here the credits are generally categorized by the loaning banks, according tothe points at where the bank has incentives to accept that the defaulter would not have an option to reimburse the advance regardless of being late or not. Advances distributed by a bank are organized into the accompanying three categories.

(i) Substandard: Advances with substantial degree of risk to the bank characterized by unfavorable records or any other unsatisfactory characteristics.

(ii) Doubtful: Any advance characterized by the ultimate realization of uncertainity and in which a substantial loss is probable.

(iii) Bad/Loss: It means an advance unlikelyto be recoverable at all and entire loss is probable.

Literature Review:

The NPLs ratios to total loan in Bangladesh banking system are going to down trend since 2000 (Adhikary, B. K., 2006).However,there is a continuous increase from 26.09% in 1990 to a top of 41.11% in 1999. In 2000 the ratio of NPLs to the total loans disbursed fell to 31.49%, in 2003 there is an additional fall of near about 10% and it had reduced to as low as 13.55% in 2005 (Annual report, Bangladesh Bank, 2004-05).

During 70s and 80s the SCBs and DFIs kept experiencing the higher level of NPLs for mainly disbursing loans with the considerations other than commercial aspects and under direct credit programs. Due to poor assessment and insufficient follow-up as well as inferior supervision of disbursed loans leads to a massive booking of less quality assets become burden in the portfolio of these banks. Moreover, reluctance of writing-off the accumulated bad loans due to poor quality underlying securities has made the situation worse. In recent years, NPLs recovery has become improved due to the measures taken to strengthening the loan recovery mechanism as well as the recovery drive with an improvement of write-off systems. According to the annual report of Bangladesh Bank, 2010-'11 the ratio of net NPLs (total of interest suspense and provisions) to net total loans (total of interest suspense and provisions) become 1.9 percent for SCBs and 16 percent for DFIs as well as 1.3 percent for Bank sector. Evidence shows that non-performing portfolio remained high event after the adjustment of actual provision and interest suspense for DFIs. However, FCBs and PCBs had excess provision against their NPLs. At the end of FY 11 all the banks, FCBs, DFIs, PCBs and SCBs shows a ratio of NPLs to net total loans 1.3, -1.5, 13.5,0.2, 2.0 respectively. The overall banking sector shows a net NPL ratio of 2.2 in 2018.however, the ratio of NPLs were 0.7, 5.7, 0.4, 11.3 for FCBs, DFIs, PCBs and SCBs respectively. Meanwhile at the end of June 2019 the NPL ratio of the sector become 2.5 percent.

Makri et al (2014) claims that with a higher level of NPLs a bank is bound to incur carrying costs on non-income yielding assets that propels the portability as well as the capital adequacy of a bank, as a result, the bank finds it hard to augment capital resources.Another study by Louzis (2012), stated that in Greek banking industry both the quality of management of the bank as well as the macroeconomic forces of the country considerably influence the NPLs.

Gianluca Bontempi, (2013) observed that inferring properties of the probability model statistical time-series can generate an observed time series from a limited set of observations. ARIMA (p, d, q) model has been used in forecasting for Stochastic Linear model.Anam et al (2017) used ARIMA (p, d, q) model for agricultural inputs forecasting.Chowdhury et al (2020) shown that non-performing advances can influence the capacity of banks to assume their part in the improvement of the economy.ARIMA (p, d, q) is well fitted model for forecasting agricultural loan and international tourist arrival in time series analysis (Rahman et al 2018, 2019).

Methodology:

Time Series Analysis

ARIMA model is applied to implement anticipating. The time arrangement models applied in this paper are quickly portrayed. A significant parametric group of fixed time arrangement is the Autoregressive Moving Average (ARMA) procedure and it undertakes a key job in the displaying of time arrangement statistics. At the point when a period arrangement isn't fixed, for the most part differencing activities are applied at the fitting slack so as to

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accomplish fixed. The mean is usually subtracted and an ARMA model is fit to the data set. A stationary zero mean ARMA (p,q) model is defined as (Brockwell and Davis, 2002) a sequence of random variables $\{X_t\}$ which satisfy, $X_t - \phi_1 X_{t-1} - ..... - \phi_p X_{t-p} = Z_t + \theta_1 Z_{t-1} + ... + \theta_q Z_{t-q}$ for every t and where $\{Z_t\}$ is a sequence of uncorrelated random variables with zero mean and constant variance σ^2. A process is said to be an ARMA process with mean μ, if $\{X_t - \mu\}$ is an ARMA (p, q) process. A process is called an ARMA (p, d, q) process if d is a nonnegative integer such that $(1-B)^d X_t$ is an ARMA (p, q) process and where B is the usual backward shift operator.

$$E(\xi_t / \xi_u, u \lhd t) = 0,\ t \in z$$

This model also incorporates the Akaike Information Criterion (AIC), Corrected Akaike Information Criterion (AICC), and Bayesian Information criterion (BIC). The AIC statistic is defined as, $AIC = -2 \ln L + 2(p+q+1),$ where L is the Gaussian Likelihood for an ARMA (p, q) process. On the contrary, the AICC statistic is defined as,

$$AICC = -2 \ln L + \frac{2(p+q+1)n}{(n-p-q-2)}.$$

Since, the AICC model has a more outrageous penalty than the AIC statistics; it would counteract fitting very large models. The Bayes Information Criterion (BIC) is given by,

BIC= -2 (Log likelihood) +p log (n).

Usually, BIC penalizes models with a bigger number of boundaries more firmly than AIC.

Results and Discussion:

Here the yearly data of NPL are collected from Annual Report, Bangladesh Bank (2004-04, 2010-11, 2018-19) that are given in below data table.

End of June	NPL in Billion(BDT)	End of June	NPL in Billion (BDT)
2019	1124.2	2009	224.8
2018	939.2	2008	224.8
2017	743.1	2007	226.2
2016	621.8	2006	200.1
2015	594	2005	175.14
2014	501.6	2004	187.03
2013	405.8	2003	203.2
2012	427.4	2002	238.57
2011	226.5	2001	235.99
2010	227.1	2000	228.51

The line graph of the above table is given below (Fig-1). To develop ARIMA (p, d, q) at first we have to go stationary test. If the data set is stationary at first time then the value of'd' is zero. If data is not stationary at first chance then we have to take the first difference (lag 1 & d=1). Gradually we have take difference until data is not stationary.

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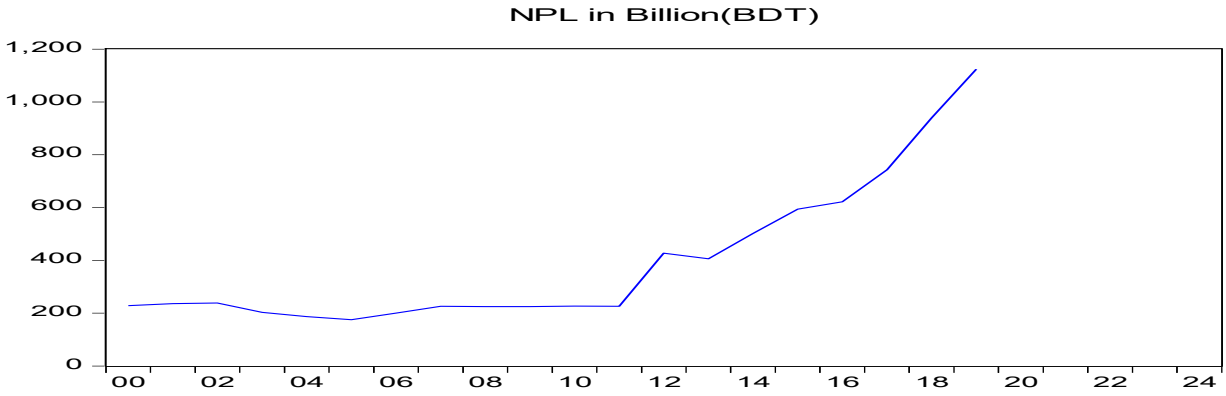

Fig-1: Time graph of NPL

For stationary test, this research consider Augmented Dickey-Fuller test. This test suggests that the absolute value of test statistic would be greater to accept alternative hypothesis (data is stationary).

Table-1: NPL Table

Null Hypothesis: NPL_IN_BILLION_BDT_ has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			3.800336	1.0000
Test critical values:	1% level		-3.831511	
	5% level		-3.029970	
	10% level		-2.655194	
*MacKinnon (1996) one-sided p-values.				

For time series analysis our prerequisite is data is to be stationary. The above graph **(Fig-1)** shows that the data is not stationary. The data are, therefore, differenced once at lag-1 and the plot is shown in

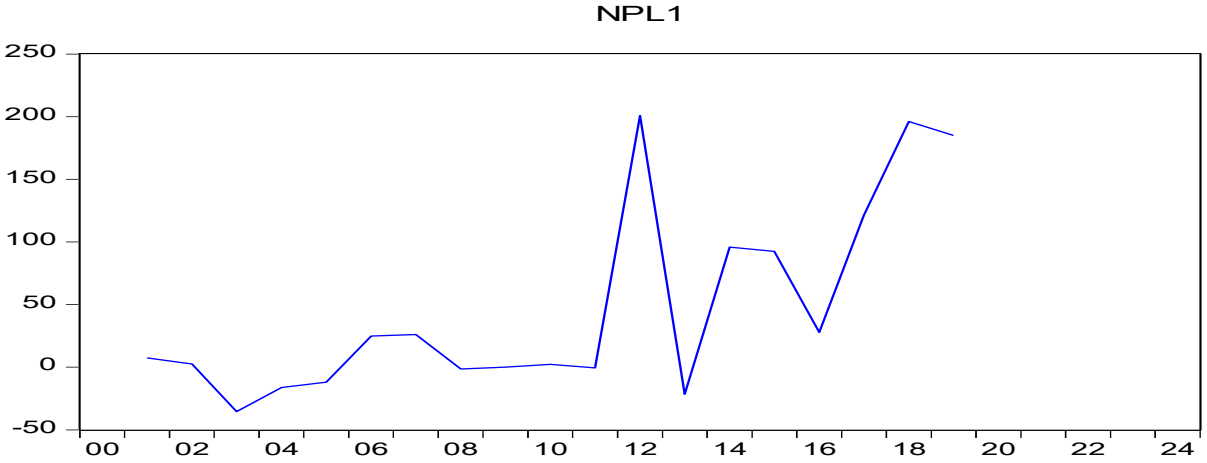

Fig-2: Lag-1 graph of NPL

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Table-2: Lag-1 table

Null Hypothesis: NPL1 has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=3)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-2.366241	0.1641
Test critical values:	1% level		-3.857386	
	5% level		-3.040391	
	10% level		-2.660551	

The above graph **(Fig-2)** shows that the data is not stationary. The data are, therefore, differenced once at lag-2 and the plot is shown in Figure-3.

This study has tested ADF and found 5.242605 which is greater than 3.920350 at 0.01 critical levels i.e. expectedly the study reject the null hypothesis. The graph and the table showed in fig-3 and table-3. Finally, it is established that data set is stationary in lag-2.

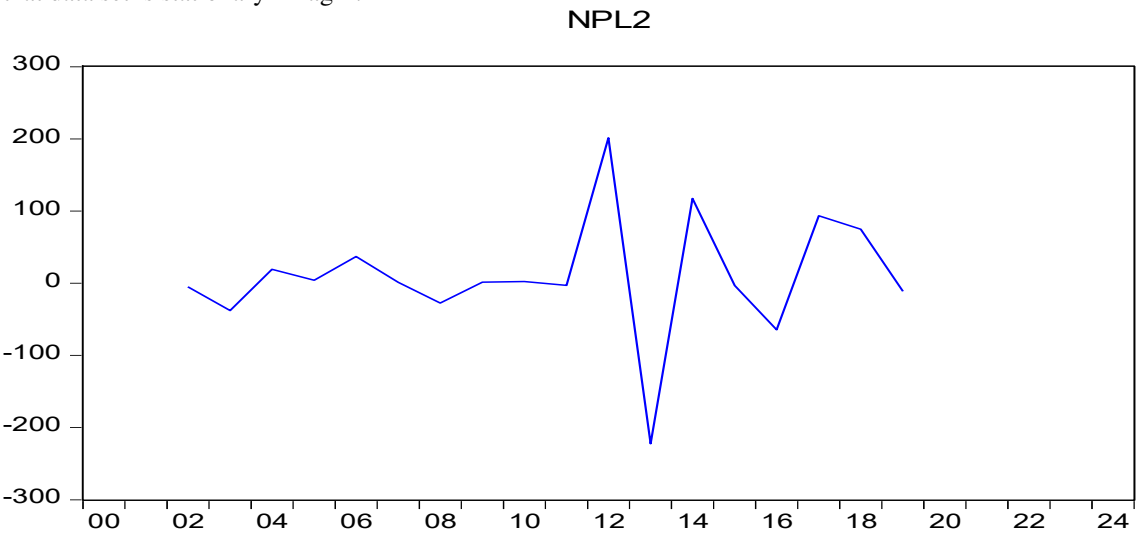

Fig-3: Lag-2 graph of NPL

Table-3: Lag-2 table of NPL

Null Hypothesis: D(NPL_IN_BILLION_BDT_,2) has a unit root				
Exogenous: Constant				
Lag Length: 1 (Automatic - based on SIC, maxlag=4)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.242605	0.0008
Test critical values:	1% level		-3.920350	
	5% level		-3.065585	
	10% level		-2.673459	
*MacKinnon (1996) one-sided p-values.				

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From the above discussion we got the data is stationary at second difference (lag 2). Therefore the value of d is two. For further analysis we have estimate the value of p and q in ARIMA (p, d, q) model. The correlogram test is well fitted to evaluate the value of p and q. In this test the significant number of large spike of Autocorrelation (ACF) indicates the value of p and the significant number of large spike of Partial correlation (PCF) indicates the value of q.

Table-4: Correlogram table for ACF and PCF

Date: 08/10/20 Time: 15:00
Sample: 2000 2024
Included observations: 18

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.593	-0.593	7.4362	0.006
		2	0.075	-0.425	7.5636	0.023
		3	0.180	-0.016	8.3407	0.039
		4	-0.262	-0.160	10.102	0.039
		5	0.059	-0.302	10.199	0.070
		6	0.169	-0.033	11.054	0.087
		7	-0.098	0.192	11.370	0.123
		8	0.070	0.275	11.544	0.173
		9	-0.120	-0.058	12.120	0.207
		10	0.035	-0.127	12.175	0.274
		11	0.008	-0.006	12.179	0.350
		12	-0.001	0.063	12.179	0.431

The above table shows that the Autocorrelation (ACF) spike is 1 so p=1 and Partial correlation (PCF) significant spike is 1, *i.e.* q=1 (Table-4).

Since p=1, d=2, and q=1 so our expected model is ARIMA (1, 2, 1) for the data. If we run this model then we got the following forecasting graph (fig-4) and the regression coefficient table (Table-5).

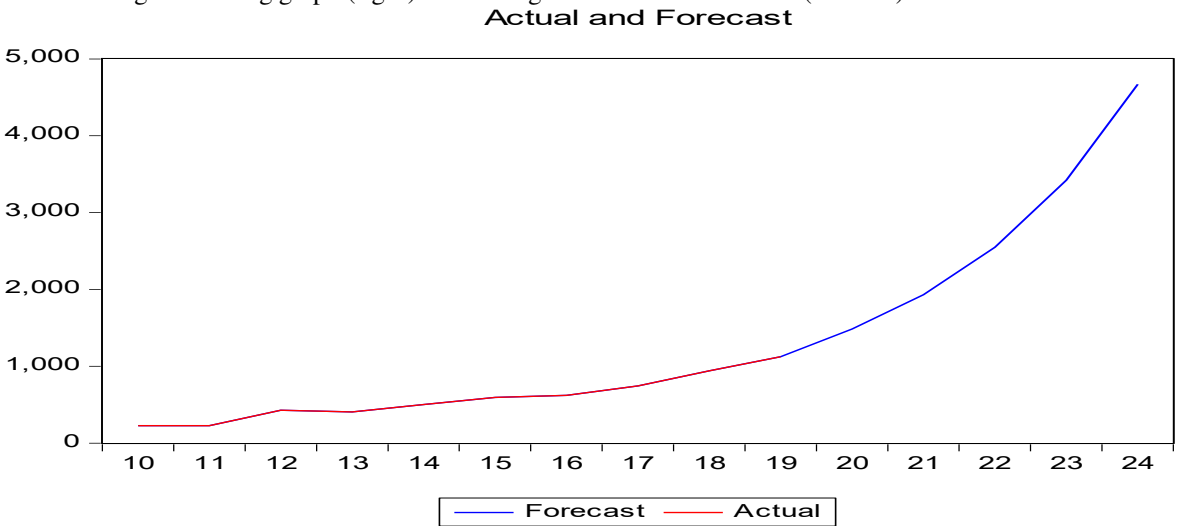

Fig-4: Forecasted graph of NPL

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Table-5: Regression coefficient table

ARIMA regression

Sample: 2002 - 2019 Number of obs = 18
Wald chi2(2) = 10.58
Log likelihood = -101.0919 Prob > chi2 = 0.0050

D2.NPL	Coef.	OPG Std. Err.	z	P>|z|	[95% Conf.	Interval]
ARMA						
ar L1.	-.2757392	.7681481	-0.36	0.720	-1.781282	1.229804
ma L1.	-.4571323	.7934885	-0.58	0.565	-2.012341	1.098077
/sigma	65.50549	7.414005	8.84	0.000	50.9743	80.03667

Hence, the fitted ARIMA (1, 2, 1) model and the forecasted graph (**Fig-4**) can be stated by the following regression line;

$$\text{NPL} = 65.50549 - 0.2757392 y_t - 0.4571323 \mu_{t-1}$$

Conclusion

Undoubtedly the amount of NPL is getting higher day by day in Bangladesh. The research developed a regression line that estimate the change of NPL with respect to time. That means, it would be easier to use this equation to predict the NPL. Therefore financial organization can easily set their goal to recovery their non performing loan as well as their future plan related this NPL. This equation also helps to measures those issues like no trade off with due ingenuity in the endorsing procedure, activity plan for potential NPL, identification of profoundly hazard delicate borrowers in the credit portfolio, identification of geographical zone shrewd risk sensitivity etc.

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